THE CANADA LAND INVENTORY OF ARDA

SIGNIFICANCE TO THE FORESTRY PROFESSION AND INDUSTRY

A PAPER TO BE PRESENTED TO

WOODLANDS SECTION

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BY

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Your Secretary-Manager, Mr. Owens, asked me to outline the Canada Land Inventory Program of ARDA, particularly the Forest Land Capability portion of it, and its possible application to as well as implications for the pulp and paper industry. This is a sizeable task in the short time allotted, but I shall attempt to fulfill the request by dealing very briefly with the technical aspects of the Inventory and concentrating at some length on the possible application of the results to industry, to our profession and to the science of land use planning.

The need for a land capability inventory has not arisen suddenly and I will not waste time documenting to this group all the evidences of abuse or misuse of the land resource. Proceeding Number 4 of the Special Committee of the Senate on Land Use in Canada, August 20, 1958, recommended "that it be called to the attention of the proper authorities the need of a systematic land use survey based upon appropriate factors to provide for an economic classification of the land according to its suitability". This recommendation was restated in Proceeding Number 12, July 8, 1952. At the Resources

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For Tomorrow Conference in 1961 the Workshops for Agriculture, Forestry, Wildlife and Recreation all pointed out somewhat similar needs which were confirmed by the Research Co-ordinators Joint Statement as follows:

1. To complete a country-wide assessment of resource supplies which may be set against long-term assessments of resource needs.
2. To make possible systematic studies of
   (a) Problems of resource management and development in all fields; and
   (b) Economic potentials and social needs in all regions.

Since the proper use of the land resource constitutes a fundamental part of a rehabilitation and development program of rural areas, an early requirement of the ARDA program was an evaluation of the physical capability of the land for agriculture and alternate uses. To this end, in November 1962, a seminar on the proposed land inventory was convened in Ottawa with participants from all regions in Canada. They expressed the unanimous opinion that an Inventory was urgently required.

On October 3, 1963 the Government of Canada approved the undertaking, under ARDA of a comprehensive land resource inventory to be known as the Canada Land Inventory. Each of the provinces conducts the inventory within its own boundaries according to national capability systems. The Federal Government reimburses the provinces for all additional direct operational and staff costs incurred in the conduct of the program and provides technical assistance and co-ordination. The Inventory area embraces the settled portions of Canada including the agriculture - forest fringe areas for which conflicts in use exist -

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a total area of approximately 800,000 square miles.

The broad objective of the Canada Land Inventory is to classify lands as to their use-capabilities and to obtain a firm estimate of the extent and location of each land class. These lands would be classified according to:

- their physical capability for use in agriculture, forestry, recreation and wildlife;
- their present use;
- socio-economic factors relative to their present use.

This vast amount of information on Canada's land resources will be gathered, stored, analyzed, and published in such a way that the Inventory will become a working tool in the rural development program in Canada.

Now I realize that the primary interest of this group is in the forest land capability program. However, so that it may be viewed in its proper context let us first look briefly at the capability systems for other uses.

Agriculture:

The national system of classification of soil capability for agriculture developed by the National Soil Survey Committee is being applied to all areas covered by systematic soil surveys ans will be extended to the whole of the agriculturally developed portion of Canada.

Briefly, the mineral soils are grouped into seven classes on the basis of their limitations for agricultural use. The first three classes are considered capable of sustained production of common field crops, the fourth class is physically marginal for sustained

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arable agriculture, the fifth class is capable of use only for permanent pasture and hay, the sixth class is capable of use only for wild pasture and the seventh class is for soils and land types considered incapable of use for arable agriculture or permanent pasture. Plants which require little or no cultivation are not considered as cultivated or common field crops.

Recreation:

This classification is still in the development stages and may change somewhat. The system is comprised of seven classes based on the natural capability of the land to provide recreation.

The degree of attractiveness, the range of recreational activities and the number of people which might be accommodated per unit area are dominant factors. Shorelands with useable terrain fronting on recreation water form the dominant type of high capability lands. Areas containing outstanding recreation features or attractions, whether or not they are water oriented, may rate parallel to shorelands with good public beach potential. Areas with good capability for extensive types of recreation, that is, with a high land requirement per user, fall into Class 4 and 5. Class 6 land has severe limitations for recreational activities and Class 7 land has an extremely limited capability for any type of recreation.

Wildlife:

Essentially the capability classification for wildlife in its present preliminary stage comprises two separate classifications, to be shown on separate maps.

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In the first, the land is rated into one of seven classes according to its ability to support the production of waterfowl. The class is determined by the inherent physical limitations to the formation and maintenance of waterfowl habitat and growth of vegetation necessary for their survival and growth. Land especially adapted to serve as migration areas are recognized as special classes.

The second wildlife classification enables rating of the land into one of seven classes based on the physical limitations of the land for the production of ungulates (hoofed animals). There may be associated with each class a range of numbers of deer and/or moose which the land will support as well as a minimum annual productivity estimate.

Present Land Use:

Major classes mapped are urban, that is land used for urban and associated non-agricultural uses; horticulture, which includes land used for the intensive production of vegetables and small fruits; orchards and vineyards; cropland, land used primarily for cash crops; improved pasture and forage crops; unimproved pasture and range land; woodland-swamp; marsh or bog; unproductive land.

In eastern Canada the present land use mapping is being carried out by the Geographical Branch, Canada Department of Mines and Technical Surveys. In western Canada the provinces are responsible for this mapping. The Geography Departments of the Provincial Universities in most cases are carrying out this mapping under the direction of the provincial governments.

Land Capability for Forestry:

Following a series of pilot scale mapping projects the classification

system of land capability for Forestry was adopted at a national meeting at which all of the provinces, forestry faculties of the Canadian Universities and Regional Offices of the Department of Forestry were represented.

Land is rated into one of seven classes based on its inherent physical limitations to the growth of commercial tree species and on its capability to produce a minimum volume of a stated species.

Associated with each capability class is a productivity class based on the mean annual increment of the best species or group of species adapted to the site, at or near rotation age. Productivity classes are expressed in gross merchantable cubic foot volume to a minimum diameter of four inches inside bark. The productivity implied here should be that of "normal" or fully stocked stands. Thinnings, bark, and branch wood will not be included.

The classes may briefly be described as follows:

Class 1

SOILS IN THIS CLASS HAVE NO IMPORTANT LIMITATIONS TO THE GROWTH OF COMMERCIAL FORESTS.

Class 1 soils are deep, permeable, well to imperfectly drained, have good water-holding capacity, are naturally high in inherent soil fertility. The landform position is such that the site will not be subject to extremes of temperature or evapotranspiration. Productivity will usually be greater than 110 cubic feet per acre per year.

When required this Class may be subdivided, on the basis of productivity, into Classes 1a (111 to 130), 1b (131-150), 1c (151-170), 1d (171-190), 1e (191-210) etc.

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Class 2

SOILS IN THIS CLASS HAVE SLIGHT LIMITATIONS TO THE GROWTH OF COMMERCIAL FORESTS.

Class 2 soils may be of such a texture as to slightly affect the level of available nutrients or moisture or there may be slight limitations due to climatic factors. Productivity will usually be from 91 to 110 cubic feet per acre per year.

Class 3

SOILS IN THIS CLASS HAVE MODERATE LIMITATIONS TO THE GROWTH OF COMMERCIAL FORESTS.

Class 3 soils may be of sufficiently coarse texture to moderately affect the supply of available moisture and nutrients or heavy-textured soils with somewhat impeded internal drainage. Rooting depth may be somewhat limited or the restricted depth may affect the available moisture. Tree growth may be noticeably affected by adverse climatic factors. Productivity will usually be from 71 to 90 cubic feet per acre per year.

Class 4

SOILS IN THIS CLASS HAVE MODERATELY SEVERE LIMITATIONS TO THE GROWTH OF COMMERCIAL FORESTS.

Class 4 soils may have limitations of texture so as to cause a deficiency or excess of moisture, the permeability may affect root penetration or the rooting depth may be definitely limited. Moderately severe extremes of climate and nutrient deficiencies may exist. Productivity will usually be from 51 to 70 cubic feet per acre per year.

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Class 5

SOILS IN THIS CLASS HAVE SEVERE LIMITATIONS TO THE GROWTH OF COMMERCIAL FORESTS.

The limitations of Class 5 soils will usually be a combination of two or more factors of climate, soil moisture, permeability, depth, fertility, lime, soluble salts, stoniness or inundation. Productivity will usually be from 31 to 50 cubic feet per acre per year.

Class 6

SOILS IN THIS CLASS HAVE VERY SEVERE LIMITATION TO THE GROWTH OF COMMERCIAL FORESTS.

The limitations of Class 6 soils will be of such a nature as to be easily identified. Such limitations as shallow to very shallow soils over bedrock, or wet soils - often peat or muck, will be characteristic. Productivity will usually be from 11 to 30 cubic feet per acre per year.

Class 7

SOILS IN THIS CLASS WILL HAVE LIMITATIONS OF SUCH A SEVERE NATURE AS TO PRECLUDE THE GROWTH OF COMMERCIAL FORESTS.

Class 7 soils will include extremely shallow soils over bedrock, very wet organic soils, inundated mineral soils, soils with extremes of climate or those very high in toxic elements. Productivity will usually be less than 10 cubic feet per acre per year.

Separate maps for each capability will be prepared at two scales - at 1:250,000 for publication in a national series and at or near 1:50,000 for calculation of area, analysis, and comparisons. Additional maps such as census sub-divisions will be prepared to allow summarization of statistics on various regional bases.

The mass of data generated and the number of maps involved are such that traditional manual methods of handling them would be impractical.

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Obviously one critical phase of the inventory is the development of a system which will enable rapid area calculation, rapid comparison within and between capabilities for a specified region and a storage and recovery system which will allow quick recall of required information.

Through contracts ARDA is developing a computer system in which map lines will be recorded on magnetic tape in a numerical form by means of an automatic scanning device. All pertinent information for any land unit, including capabilities, present use, economic factors and population characteristics can then be placed on the tape along with the land unit. When perfected this will allow rapid area calculation, rapid multiple comparisons and the maps may be printed out at any required scale. With projected improvements in computer techniques it is quite possible that before the Inventory is complete, corrections, additions or deletions can be effected with direct map projections from the tape.

Now what I have described, admittedly very briefly, is the physical base which the Canada Land Inventory was designed to provide. In my opinion this in itself constitutes a milestone in land use planning in Canada; for the first time land planning based on the physical capability of the land for its various uses will be possible.

We realize, however, that a great many factors other than the physical capability must be considered in the process of land use planning. The most important of these can be grouped into what I will call economic considerations.

We have only begun to give serious consideration to this aspect of the Inventory and, therefore, I can only deal with it in generalities.

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Since economic assessments must be based on accumulated physical data we have had to await the completion of the mapping of sizeable areas. Furthermore, economic assessments tend to be regional in nature and do not lend themselves, as do physical criteria, to national interpretation. Nevertheless, in order to be of maximum value the economic criteria should provide answers, as of a given time to certain questions:

1. Will there be a demand for the product when it is harvested?

It is probably unnecessary to dwell on this aspect; certainly it is obvious that land should not be devoted to a product for which there will not likely be a demand or stated in another way should be devoted to production for which a demand can reasonably be expected to exist.

2. What are the economic evaluations which correspond to the physical capability classes?

If we think of the capability classes for forestry, for example, there should be economic ratings for each of the physical capability classes. Only in this manner are we likely to know on which areas reforestation or improvement practices are economically justified, even assuming a good demand for the product. It may be that only capability classes 1 to 4 will yield reasonable returns on the investment required for reforestation and "subsequent management". Alternately the cost of wood grown on this reforested land may be found to be higher than that available from natural forests, in which case the decision will rest on other considerations.

3. When submarginal land for agriculture has a similar capability for several alternate uses to which use should it be devoted?

Although a great many considerations must be taken into account, in the final analysis the greatest return for the least cost, once again assuming positive demand, must be the final yardstick. This, of course,

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is an extremely complex problem but certainly the economics of alternate uses must be available to the planner.

4. How much land of the various physical capabilities are necessary to constitute a viable unit?

Essentially this is the question of economy of scale but it is a very important aspect of land planning and management.

In summary, then, the object of the economic assessments will be to ensure that marginal or sub-marginal land for agriculture is not unwittingly devoted to an alternate use for which it also may become marginal or sub-marginal.

As ARDA has developed toward a comprehensive program of rural development the need for indicators of population characteristics as related to land use have become apparent. Therefore, procedures are being investigated to relate certain rural manpower employment statistics from the Census Data to land use patterns in rural areas. Of necessity these comparisons will be on a broad regional scale.

Before proceeding to the implications of the program I think it might be useful to consider a few results from a small area in Ontario so that we might have some indication of the magnitude of the problem with which we are dealing. The nine most easterly counties of Ontario - Carleton, Dundas, Glengarry, Grenville, Lanark, Leeds, Prescott, Russell and Stormont have a total area of 5,594,000 acres. Of this total, 2,070,000 acres or 58 per cent are classified as cleared land. Approximately 816,000 acres or 39 per cent of this cleared land has been classified by the Ontario Soil Survey of the University of Guelph as marginal or sub-marginal for agriculture, that is as capability 4 to 7 inclusive for agriculture. About 550,000 acres or 00

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per cent of this marginal and sub-marginal agricultural land is classified as capability 1 to 4 for forestry according to land capability for forestry maps prepared by the Ontario Department of Lands and Forests. Thus at least from a physical standpoint, 650,000 acres of cleared land in the nine eastern counties of Ontario are more suitable for forestry than for agriculture. An additional 150,000 acres or 18 per cent of the marginal and sub-marginal land for agriculture have been classified as capabilities 5 and 6 for forestry but, of course, this land may well be sub-marginal for forestry as well. Now from these data we cannot assume that 650,000 acres should be reforested. Obviously the nature of the physical limitations and, as mentioned earlier, the economics of wood production will exercise a major influence. Furthermore, the possibility of use for other alternatives such as wildlife, recreation or "conservation reserves" have not been considered in this discussion. What these data are intended to indicate is that the program will reveal a tremendous amount of information, heretofore unavailable, on which to base decisions for effective land use.

We come now to the consideration of the impact of this program on land use policy and its implications to forestry - the industry and the profession. The administration of the land is within the constitutional jurisdiction of the provinces; thus the results will be of greatest immediate value to the provinces. There is, however, no doubt that the information on the land resource available from this inventory will be the basis for land use policy and planning for many years. Let us consider for a moment what land planners can do with this information assuming a favourable political and economic climate. It will permit:

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1. An appraisal of how much land presently in agriculture will likely remain in agriculture.

2. A plan for consolidation of farms located on good agricultural land into economically viable units.

3. A realistic estimate of the magnitude of farm improvement practices such as drainage which might be carried out within a given region.

4. A calculation of lands now in agriculture which should be devoted to another use and alternately land not yet developed for agriculture which should be reserved for that purpose.

5. A plan for the reservation and subsequent development of land for recreation, wildlife, or other uses.

6. A plan for the reforestation of lands whose use for that purpose have been shown to be physically and economically feasible.

7. Consolidation of forested lands into economically viable units.

8. The consolidation of certain lands which may well be uneconomic for any of the generally accepted uses into blocks which, for want of a better term, may be called "conservation reserves".

These are only a few of the more obvious possibilities but one does not need a license for crystal ball gazing to realize the significance of this type of land use planning. The primary implication to industry is the possible increased wood supply, almost all located along excellent roads and relatively close to major population centres. It is not inconceivable that major pulp and paper, plywood or other industries will be established with practically no wood inventory and no limits or forest reserves as we now understand them. In this respect you are in a much better position than I am to calculate the

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resultant savings from an operation of this type. Such things as species availability, and wood quality all would be affected but I do not propose to go into these things to any extent. Also harvesting methods could well become more similar to some of those presently employed in agriculture than in forestry, but here again the imagina tion should not be allowed to run rampant. The greatest potential impact will be on the marketing of this wood because of the opportunity, before sale, to process it into the various products for which it is best suited and which will bring the best price. Thus marketing of raw wood products on a large scale from central yards may well be an inevitable result of this trend.

Finally, I would like to deal with the impact that a land use policy and land use planning of the type which we have been discussing will have on our profession. Up to now, I have been describing the Canada Land Inventory program of ARDA which was designed primarily to cover the agricultural or settled portions of Canada. A similar program to classify the forest and wildlands of Canada is also, in my opinion, a requirement as a basis for planning and management. In fact, a step in this direction has been made with the formation of a National Committee on Forest Land which held its first meeting in Ottawa on January 26 - 27 of this year. This Committee consists of official delegates from each of the Provinces, Forestry Faculties of the Canadian Universities and Regional Offices of Canada Department of Forestry as well as representatives from other agencies with responsibilities for land classification and administration. One of the terms of reference of this committee is to "investigate and make recommendations on a system of forest land inventory which would

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serve as a basis for sound forest management and rational use of wild-lands". Now if we assume, as I think we must, that a physical base for land-use planning will, within the foreseeable future, become available what then should the Forester's role be in this planning process?

If the Forester is to occupy a useful professional place in resource management he must become a land manager rather than an exploiter of the wood crop. To use an analogy, he must become the lands general practitioner rather than merely its barber. It is logical that the Forester, because of his responsibility for vast areas of wildland, should become the manager of this land. However, he will certainly not be entrusted with this responsibility unless he demonstrates a capability to carry it out.

A knowledge of the possible uses for forest and wildland for other than forestry is essential to intelligent planning and management. Recreation, wildlife, water production and control, park or wilderness reserves are all occupying an increasingly important place in our affluent society and must be taken into account in the planning process. To fulfil this role, the graduate Forester must broaden his outlook beyond the confines of identifying, measuring, and removing the forest crop. Furthermore, our Canadian Universities must begin to train land managers by means of a curriculum designed to acquaint its graduates with the whole spectrum of resource management. If we do not adapt to this evolution of principles and practices then the possible implications of programs such as the Canada Land Inventory to the profession of Forestry may well be greater than we care to consider.

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In closing then, may I say that the impact of the Canada Land Inventory on industry, and the Forestry profession will be tremendous, in part because of its direct influence on wood availability and marketing but to a much greater degree because it will enable, for the first time in Canada, formulation of new land use policies based on the inherent properties of the land.